

WHAT IS CLAIMED IS:

1. A broadcast program storing system, comprising:  
a preference learning means for learning preferences of a user for programs by viewing behavior of said user;  
a degree of preference predicting means for predicting the degree of preference of said user for said programs by obtaining program information; and  
a storing planning means for choosing programs by solving a temporally expanded knapsack problem that obtains a solution in which the sum of predicted degree of satisfaction of said user in a planned schedule becomes maximal within a bound of a recording medium, when programs to be stored and programs to be deleted are decided.
2. A broadcast program storing system in accordance with claim 1, wherein:  
said storing planning means makes a storing plan of programs in the future and also makes a plan of the deleting time of stored programs at the same time.
3. A broadcast program storing system in accordance with claim 2, wherein:  
said storing planning means makes said storing plan of said programs by utilizing efficiently a region of said recording medium where a program that said user reserves to record is recorded until right before said program starts.
4. A broadcast program storing system in accordance with claim 2, wherein:  
said storing planning means makes said storing plan of said programs by using a two-step-method in which first a program set to be

5 stored at the ending time of said planned schedule is obtained and a program set to be stored at the intermediate time of said planned schedule for storing in the remaining vacant region of said recording medium is added.

5. A broadcast program storing system in accordance with claim 4, wherein:

when said storing planning means makes said storing plan of said programs by using said two-step-method,

5 said program set to be stored at the ending time of said planned schedule is obtained by a dynamic programming in which a solution that makes the sum of said predicted degree of satisfaction of said user maximal is obtained.

6. A broadcast program storing system in accordance with claim 4, wherein:

when said storing planning means makes said storing plan of said programs by using said two-step-method,

5 said program set to be stored at the ending time of said planned schedule is obtained by a greedy method in which a quasioptimal solution of said predicted degree of satisfaction of said user is obtained by choosing a larger predicted degree of satisfaction in a predicted degree of satisfaction by unit storing time and a predicted  
10 degree of satisfaction by unit storing time  $\times$  survival time.

7. A broadcast program storing system in accordance with claim 4, wherein:

when said storing planning means makes said storing plan of said programs by using said two-step-method,

5 said program set to be stored at the intermediate time of said

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claim 6, wherein:

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claim 7, wherein:

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claim 6, wherein:

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10 one is calculated.

11. A broadcast program storing system in accordance with claim 7, wherein:

when said storing planning means uses said greedy method,  
 said storing plan is made by that a ratio among viewing  
 5 minutes of each genre of programs of said user is obtained by the  
 statistics of the past viewing behavior of said user, and a discount rate  
 for part exceeding from said viewing minute ratio of each genre is  
 calculated and the balance among said genres is kept, when the degree of  
 satisfaction at the time that the programs to be stored are chosen one by  
 10 one is calculated.

12. A broadcast program storing system in accordance with claim 5, wherein:

said predicted degree of satisfaction is a predicted degree of  
 preference, or said predicted degree of preference  $\times$  a program length, or  
 5 said predicted degree of preference  $\times$  said program length  $\times$  survival  
 time.

13. A broadcast program storing system in accordance with claim 6, wherein:

said predicted degree of satisfaction is a predicted degree of  
 preference, or said predicted degree of preference  $\times$  a program length, or  
 5 said predicted degree of preference  $\times$  said program length  $\times$  survival  
 time.

14. A broadcast program storing system in accordance with claim 7, wherein:

said predicted degree of satisfaction is a predicted degree of

preference, or said predicted degree of preference  $\times$  a program length, or  
 5 said predicted degree of preference  $\times$  said program length  $\times$  survival  
 time.

15. A broadcast program storing system in accordance with  
 claim 1, wherein:

said degree of preference predicting means and said preference  
 learning means, comprising:

5 a system, wherein:

an electronic text being program information received from  
 broadcasting or telecommunication is transformed into an attribute  
 vector consisting of keywords;

10 a preference function expressing a relation between an  
 estimated degree of preference estimated from viewing behavior of a user  
 and said attribute vector is learned;

a preference function value of said attribute vector is made to  
 be a predicted degree of preference for a program to be stored;

15 a virtual specialist that predicts only when a keyword is in said  
 attribute vector for every program, and weighting of said virtual  
 specialist are set;

said prediction is implemented by a weighted average  
 prediction of said virtual specialist; and

20 learning is implemented by adjusting said weighting,  
 at said system,

as a predicted value of said virtual specialist corresponding to  
 each keyword, an average value of said estimated degree of preferences  
 of programs having said attribute vector including the keyword, or a  
 Laplace estimation value (accumulated estimated degree of preference +  
 25 0.5) / (number of appearances + 1.0) of said estimated degree of  
 preferences is used; and

learning is implemented by that weighting of said virtual specialist of the estimated degree of preference  $q$  is multiplied by  $r q / p + (1-r)(1-q)/(1-p)$ , in this,  $p$  is a predicted weighted average of said  
 30 virtual specialist and  $r$  is an estimated degree of preference from actual viewing behavior of said user.

16. A broadcast program storing system in accordance with claim 1, wherein:

at said degree of preference predicting means and said preference learning means, a system is used, and

5 said system, comprising:

a preference information server via a telecommunication means, wherein:

similarity of preferences among users is learned by the estimated degree of preferences of past programs transmitted via said  
 10 telecommunication means; and

a degree of preference of a user to be predicted for a future program to be stored by said user is estimated by using the estimated degree of preferences of said users for programs transmitted already and said similarity between said user to be predicted and said users,

15 at said system,

a virtual specialist and weighting that implement a prediction, only when the estimated degree of preferences of similar users for every similar user of each user is known, are set,

prediction is implemented by the weighted average of the  
 20 prediction of said virtual specialist,

learning is implemented by adjusting said weighting,

the estimated degree of preference of said similar user is used as the predicted value of said virtual specialist corresponding to each similar user, and

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25 learning is implemented by that the weighting of said virtual specialist of the estimated degree of preference  $q$  is multiplied by  $r q / p + (1-r)(1-q)/(1-p)$ , in this,  $p$  is a predicted weighted average of said virtual specialist and  $r$  is an estimated degree of preference from actual viewing behavior of said user.

17. A broadcast program storing system in accordance with claim 1, wherein:

both of said virtual specialist claimed 15 and said virtual specialist claimed 16 are used, and said prediction is implemented by the  
5 weighted average of said two specialists, and

learning is implemented by that weighting of said claim 15 is multiplied by  $r p_c / p + (1-r)(1-p_c)/(1-p)$ , and weighting of said claim 16 is multiplied by  $r p_s / p + (1-r)(1-p_s)/(1-p)$ , in this, a predicted degree of preference by said claim 15 is defined as  $p_c$ , a predicted degree  
10 of preference by said claim 16 is defined as  $p_s$ , a final predicted degree of preference (average of the predicted degree of preference by both said claims 15 and 16) is defined as  $p$ , and an estimated degree of preference estimated by said viewing behavior is defined as  $r$ .

18. A broadcast program storing system in accordance with claim 1, wherein:

both of said virtual specialist claimed 15 and said virtual specialist claimed 16 are used, and said prediction is implemented by the  
5 weighted average of said two specialist, and

learning is implemented by using the weighted average of all of said virtual specialists instead of predicted weighted average  $p$  of said claims 15 and 16.

19. A broadcast program storing system in accordance with

claim 1, wherein:

at said degree of preference predicting means, the weighted average of standard deviation of said predicted degree of preference of  
5 each virtual specialist is regarded as being uncertainty, and final predicted degree of preference is that constant times of said uncertainty is added to said predicted weighted average of said virtual specialists.

20. A broadcast program storing system in accordance with claim 1, further comprising:

recompressing means for recompressing stored data of said programs stored once.

21. A broadcast program storing system in accordance with claim 1, further comprising:

compression rate designating means for designating a compression rate for each program when each program is stored.

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